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Emergency Medical Transportation

A Survey of California Ambulance Operations

IRMA M. WEST, M.D., C. EARL GETTINGER, JR., DOROTHY MEYER, MICHAEL ROSENTHAL, RICHARD SNOW, FLORENCE R. WEINER, R.N., AND LE MAR W. HOAGLIN, *Berkeley*

■ *The most urgent recommendation expressed by physicians, Red Cross officials, ambulance operators and others polled in this ambulance survey was to make much more emergency medical care training available to ambulance personnel. Very few sick and injured receive first aid before an ambulance arrives. Therefore there is also an urgent need to train and motivate the public to provide first aid at the scene of the emergency. Urban ambulances usually respond within 10 minutes, but often rural ambulances take more than 30 minutes to reach an emergency. It is during this interim that lives which could be saved by prompt first aid are lost. Little use has been made of aircraft as emergency ambulances; in 1968, only one emergency trip in 1500 was made by helicopter. Also, California has fewer ambulances which make fewer emergency trips on a population basis than the country at large.*

Communications at all levels need attention. Seventy-eight percent of the ambulance operations serving the public are not listed among the emergency numbers on the inside front page of telephone directories. Less than ten percent of ambulances have direct radio communication with hospitals.

In California most ambulance services are commercially operated and there are formidable financial problems which must be solved before these services can be brought into place as a part of the emergency medical care system.

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The opinions, findings and conclusions expressed in this publication are those of the authors and not necessarily those of the State of California or the Federal Highway Administration National Highway Safety Bureau.

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Reprint requests to: I. M. West, M.D., Bureau of Adult Health and Chronic Diseases, State Department of Public Health, 2151 Berkeley Way, Berkeley, Ca. 94704.

A STATEWIDE SURVEY OF CALIFORNIA Ambulance Operations was undertaken to gather basic data about the number, distribution, level of service, and other characteristics pertinent to ambulance services in California—information which never before had been available for the state as a whole. The survey was necessary to plan for

TABLE 1.—*Ambulance Services and Ambulances by Type of Ambulance Service, Ratio of Ambulances to Service, California, 1969*

Ownership of Ambulance Service	Services or Operators		Ambulances		Number Ambulances per Company or Service
	Number	Percent	Number	Percent	
Total	535	100	1,557	100	2.9
*Serving Public**					
Commercial	177	33	602	39	3.4
Funeral director	36	7	124	8	3.4
Private or nonprofit hospital	8	1	15	1	1.9
Local tax supported hospital	13	2	53	3	4.1
Volunteer fire department	25	5	33	2	1.3
Municipal, district or other regular fire department	37	7	65	4	1.8
Police department	7	1	24	2	3.4
Voluntary organizations	14	3	15	1	1.1
Other local government services and miscellaneous	14	3	57	4	4.1
*Serving Special Groups***					
Industrial	62	12	88	6	1.4
Military	92	17	401	26	4.4
State government	26	5	35	2	1.3
Federal—nonmilitary	13	2	29	2	2.2
Other	11	2	16	1	1.5

Source: Ambulance Survey, California Department of Public Health, 1969.

*Sixty-two percent of the ambulance operations serve the general public. Sixty-three percent of the ground ambulances in California serve the general public.

**Two hundred and four or 38 percent of the ambulance operations serve special groups. Five hundred and sixty-nine or 37 percent of the ambulances in California serve only special groups.

compliance with the Federal Highway Safety Standard for Emergency Medical Care for Traffic Accident Victims. This standard requires a state program in cooperation with local political subdivisions to ensure that persons involved in highway accidents receive prompt emergency medical care. The survey, begun in 1968 and completed in 1970, was conducted by the California State Department of Public Health through an agreement with the State Business and Transportation Agency with funding assistance from the National Highway Safety Bureau.

The principal source of data was a questionnaire mailed to all ambulance operations; 95 percent responded, thereby providing comprehensive statewide data. A special study of air ambulance operations was carried out primarily by personal interview. Additional data were collected from emergency room physicians, California Highway Patrol Area Commanders and local chapters of the American National Red Cross by mailed questionnaires. Other studies were made on the following subjects: ambulance accidents, local ambulance ordinances, legal problems in ambulance operations, and work injuries of ambulance personnel. For these, data were collected from county Emergency Medical Care committees, court and other legal records, and the Bureau of Labor Statistics and Research of the State Department of Industrial Relations. The full report covers almost 500 pages. This article is a short summary.

The survey produced a number of unexpected findings and provided data to confirm and sometimes question widely-held opinions of knowledgeable persons in the field of emergency medical transportation.

An unexpected finding was the number of ambulance services, companies or operations in the state—612 ground ambulance and 88 air ambulance services. They exceeded previous estimates by a considerable margin. Also unexpected was the large proportion of ambulance operations (38 percent) serving special groups such as military and industry, but not the general public. Another surprising finding was the small proportion of services for the public which are operated by tax-supported agencies such as fire and police departments (20 percent). Most ambulance operations available to the California

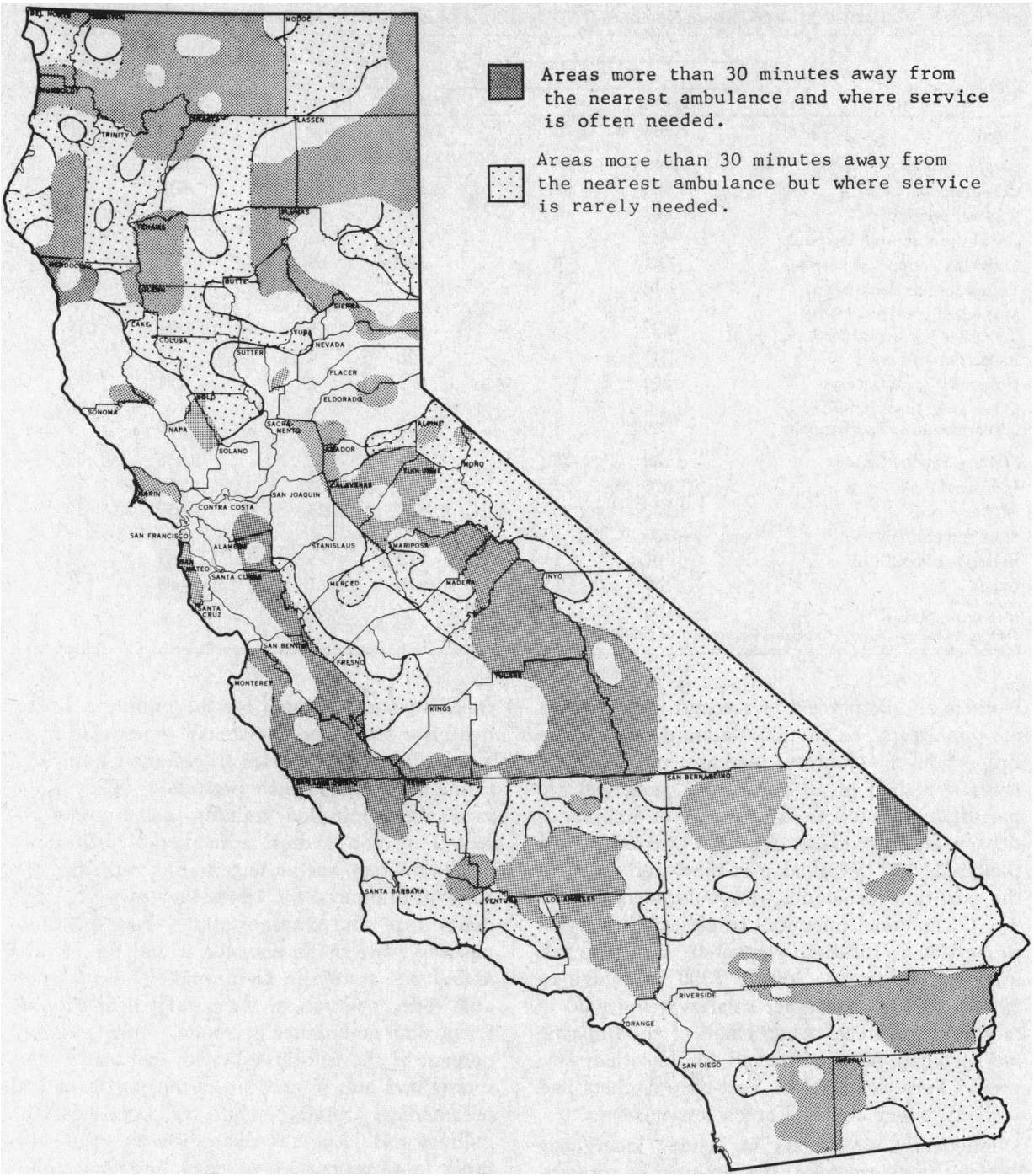

Figure 1.—Areas designated by ambulance operators and/or California Highway Patrol as being more than 30 minutes from some ground ambulance service.

public come from commercial operations, (65 percent); very few are from funeral homes (11 percent). (See Table 1.)

A significant finding was that medical emergencies occurring within about one-fourth of the California's geographic area are over 30 minutes away from the nearest ground ambulance. Not included in this estimate are unpopulated areas without traffic where there is little need for service (Figure 1).

Perhaps not unexpected is the fact that most ambulance personnel (68 percent) are part-time

TABLE 2.—*Ambulance Personnel by Type of Ambulance Service, California, 1969*

Ownership of Ambulance Service	Ambulance Personnel					
	Total		Full-Time		Part-Time	
	Number	Percent	Number	Percent	Number	Percent
Total	8,196	100	2,619	100	5,577	100
Serving Public	*5,046*	*62*	*1,824*	*70*	*3,222*	*58*
Commercial	1,966	24	1,154	44	812	15
Funeral Director	277	3	138	5	139	2
Private or nonprofit hospital	33	a	10	a	23	a
Local tax supported hospital	192	2	126	5	66	1
Volunteer fire department	446	5	4	a	442	8
Municipal, district or other regular fire department	817	10	192	7	625	11
Police department	740	9	6	a	734	13
Voluntary organizations	202	2	1	a	201	4
Other local government services and miscellaneous	373	5	193	7	180	3
Serving Special Groups	*3,150*	*38*	*795*	*30*	*2,355*	*42*
Industrial	1,077	13	123	5	954	17
Military	1,672	20	617	24	1,055	19
State government	239	3	23	1	216	4
Federal—nonmilitary	97	1	13	a	84	2
Other	65	1	19	1	46	1

[a]Less than 1 percent.
Source: Ambulance Survey, California Department of Public Health, 1969.

workers and 23 percent of the part-time workers are volunteers. As the population decreases, the proportion of volunteers increases until in rural areas over half of all ambulance personnel are part-time volunteers. The number of ambulance drivers and attendants reported was 8,196. Of the total, 5,577 worked part-time, and 1,266 of the part-time personnel were volunteers (Table 2). Commercial operators employed the largest proportion of full-time personnel. Full-time salaries ranged from a low of $300 to a high of $900 a month, the higher salaries being paid in metropolitan areas. Almost half of the full-time workers had been employed for less than two years. Turnover is high. Part-time workers had worked longer and had much less turnover.

Practically no courses in driving emergency vehicles are provided for ambulance drivers. About 40 percent of them are not required to have a state ambulance drivers' license, usually because they operate on government or private property or are police or firemen.

First-aid training is provided almost entirely by the American National Red Cross; very few personnel attend other courses offered. Two out of three ambulance operators believe that the advanced Red Cross first-aid course, although excellent basic training for the public, is inadequate for ambulance personnel. They also favor a state licensing program in emergency medical training for ambulance personnel. They favor medically controlled training—not training directed by non-medical educational institutions.

The military has an outstanding record in the survival of injured for whom they provide emergency care and transportation; therefore comparisons were made between it and the civilian ambulance system in California. The most notable difference was in the paramedical training for civilian ambulance personnel. Only about 19 percent of the full-time civilian ambulance personnel and only 7 percent of the part-time had paramedical training, while 85 percent of the military did. Another difference was the military's large proportion of truck and van ambulances which have sufficient room to provide lifesaving services. Also different was communications. The military were more likely to have direct radio communication with hospitals than were civilian ambulances.

Injured or ill persons seldom receive first aid before an ambulance arrives. If first aid is provided, law enforcement officers are the most likely providers. With respect to lifesaving emer-

TABLE 3.—*Emergency Trips and Traffic Accident and Dry Run Trips Which Were for Emergencies, by Type of Ambulance Service, California, 1969*

Ownership of Ambulance Service	Total Trips	Emergency Trips		
		All Emergency Trips	Traffic Victim Trips	Dry Runs
Total	849,209	361,692	120,906	39,113
Serving Public	*743,182*	*338,577*	*118,353*	*35,915*
Commercial	484,555	187,961	71,983	19,440
Funeral director	32,619	10,470	3,786	993
Nonprofit or private hospital	3,474	1,214	473	60
Local tax supported hospital	49,891	1,448	497	67
Volunteer fire department	3,322	2,023	989	133
Municipal, district or other regular fire department	30,001	19,672	5,142	1,547
Police department	25,998	25,951	7,095	10,347
Voluntary organizations	1,666	1,247	663	64
Other local government agencies or services	111,656	88,591	27,725	3,264
Serving Special Groups	*106,027*	*23,115*	*2,553*	*3,198*
Industrial	7,798	4,607	108	114
Military	75,716	15,565	2,244	2,913
State government	16,876	2,476	73	141
Federal—nonmilitary	869	201	79	18
Other	4,768	266	49	12

Source: Ambulance Survey, California Department of Public Health, 1969.

gency first aid, this interval can be the most critical and can be filled only by providing every citizen with first-aid training and the incentive to use it.

Communication Equipment

Much is to be desired in communications equipment and systems. More than half of the operators do not always notify hospitals of the impending arrival of emergency patients. Some cannot for lack of radios; others find it serves no purpose. Less than 10 percent of the commercial services have direct radio communications with hospitals, while 28 percent of the military do. Eighty-seven percent of the ambulances serving the general public, but only 52 percent of the vehicles serving special groups, have two-way radios at their headquarters. About 44 percent of the operations serving the public report ineffective or difficult radio communication in some parts of the area served. Only one county has a coordinated communication system with central command and control, and central receiving and dispatch, for all public emergency services including ambulances.

In the forefront of rapidly developing ambulance communications are monitoring systems which transmit vital signs from ambulance patients to the emergency room during the trip to the hospital. These systems are demonstrating lifesaving capabilities for acute heart emergencies. They are in operation in Belfast, Moscow and New York. Pilot programs of this type are now in operation in Los Angeles and soon may be in San Francisco.

Seventy-eight percent of the ambulance operations serving the public are not listed among the emergency numbers on the inside front page of telephone directories. Thirteen percent of the operators serving the public are not listed anywhere in the telephone directory. The proposed Universal Emergency Number 911 was not in operation anywhere in the state at the time of the survey although it was under consideration in several cities.

In California for 1968 about 46 percent of the total number of ambulance trips (almost 850,000) for the public were emergencies (Table 3). According to one report, the national average for emergency trips is 15 percent of the total. According to another report it is 33 percent. Apparently, in California a higher proportion of

ambulance trips are reported as emergencies than elsewhere in the country. However, the ratio of emergency trips to population is only half the national average of one emergency trip each day for each 10,000 population. In California in 1968, the ratio was one emergency trip a day for each 20,000 population. This apparent underutilization of ambulance services is substantiated by the fact that California has only six percent of the nation's ambulances. The expected number would be closer to ten percent because approximately ten percent of the population lives in California.

Traffic accident victims accounted for 14 percent of the total trips and 33 percent of the emergency trips. Commercial ambulance operators made the most trips of all kinds. In rural areas thirty-two percent of the emergency trips were for non-residents while in metropolitan areas only five percent were for non-residents.

One thousand five hundred and fifty-seven ambulances were reported by the 535 operators surveyed. The 331 operations serving the public reported 988 ambulances. The ratio of vehicles serving the public to population is about one ambulance for every 20,000 population and one service for about 60,000 population. About half of the ambulances operating in the state are over four years old. Only about half have sufficient height or head room to allow certain life-saving services to be provided.

Ambulances serving the public use the red light and siren for the right-of-way and privilege of exceeding the speed limit to the scene of an emergency most of the time. However, once the patient is on board, the red light and siren are not used most of the time. A significant majority of operators are not in favor of discontinuing the red light and siren and its attendant privileges for California ambulances. The "usual" response time for metropolitan and city ambulances to reach the scene of an emergency is ten minutes or less, with about the same time to transport the patient to the hospital. The response time is longer and too variable to be estimated for rural areas.

Nine out of ten operators serving the public always have both an attendant and a driver on ambulances responding to emergency calls, and almost 90 percent favor a law requiring both. (The present law requires only a driver but steps are being taken to require both.)

Saturday is the busiest day, 3 p.m. to 6 p.m. the busiest hours, and summer the busiest season for most ambulance services.

Financial problems overshadow all others as far as most commercial ambulance operators are concerned. Of operators who charge for services, fewer make a profit than break even or show a loss. Most commercial operators have some other business, and without its financial assistance many could not operate. Collections vary widely and delays and "red tape" for charges collected pose additional expense. Half of the ambulance services make fewer than 600 trips annually, although more than three times that number is considered minimum to support one full-time ambulance. Commercial services average just over three ambulances each. It is clear from data that ambulance operations need greater financial assistance if they are expected to raise their standards of service or to comply with any additional legal requirements. It is also clear that government agencies must assume greater responsibility for providing ambulance services where it is needed, but unavailable or too far away.

Equipment for First Aid

Over 500 ambulance operators rated 47 pieces of first aid equipment and supplies which have been most often included on recommended or required lists of minimal equipment for ambulances. Two-thirds of the operators agreed on 21 items as essential. These items in rank order are: flashlight, portable stretcher, portable oxygen and breathing equipment, dressings and compresses of assorted sizes, ambulance cot, clean linens, pillow, universal dressings, emesis basin, adhesive, suction equipment, mouth-to-mouth airways, transparent oxygen mask, triangular bandages, tourniquets, roller bandages, oropharyngeal airways, towels, wool blanket, oxygen driven resuscitator and aspiration bulb. Not included as essential by two-thirds of the operators were splints, safety pins, spine boards, and bag and mask resuscitators, all of which appear on the American College of Surgeons' list of minimal equipment for ambulances. Also absent among items judged essential by two-thirds of the operators were four items on the list of equipment required by the ambulance regulations of the California State Highway Pa-

trol. They are: splints, bag and mask resuscitators, sandbags and hemostats.

Ninety-two California physicians, selected for their expertise in emergency medical care, rated the same list as was rated by ambulance operators. Of the 47 items, 23 were rated essential by two-thirds of the physicians. Of these 23 items, 16 had been rated as essential by two-thirds of the ambulance operators. The 23 items considered essential by the physicians in the order rated were: flashlight, oropharyngeal airways, portable oxygen and breathing equipment, universal or large dressings, suction equipment, adhesive tape, bag resuscitator and mask, portable stretcher, ambulance cot, non-porous dressings, dressings and compresses of assorted sizes, mouth-to-mouth resuscitation airways, transparent oxygen masks, aspiration bulb, emesis basin, clean linens, tourniquets, spine boards, pillow, safety pins, kerlex roller bandage, extrication tools, and blood pressure cuff. Missing from this list were splints and triangular bandages which appear on the American College of Surgeons' list. Also missing were splints, triangular bandages, towels, blankets, gauze roller bandages, sandbags, and hemostats which appear on the list of required equipment for ambulances in the California State Highway Patrol regulations. (Bandage shears were inadvertently omitted from the list of 47 items. They probably would have rated high.)

A number of physicians pointed up the disproportionate emphasis placed on ambulance "hardware" when training of personnel who use the equipment should be the prime consideration.

Of the 47 items there was agreement on only seven among four groups, namely two-thirds of the California operators, two-thirds of a selected group of California emergency room physicians, the American College of Surgeons (through its list of minimal equipment) and the California Highway Patrol (through its list of equipment required on California ambulances). These seven items were: portable oxygen and its breathing equipment, transparent oxygen masks, dressings and compresses, adhesive, pillow, suction equipment and mouth-to-mouth airways.

The most unexpected result of the equipment survey was the relatively low regard in which splints were held by both operators and physicians. Considering that surgeons and orthopedists highly recommended padded board splints and hinged half-ring splints, this result was puzzling, considering a study of ambulance trips made in California in 1963[1] in which it was observed that the most frequently noted omission of ambulance personnel was neglecting to splint fractures, particularly those of the femur where bleeding can occur in massive amounts. The traction half-ring splint, unpopular with California ambulance operators, is most often recommended for femur fractures.

Another point of interest is the relatively low regard by operators for the bag and mask resuscitator, this item ranking 24 on a list of 47 pieces of equipment. Nevertheless, 60 percent of the operators did consider it necessary. This item is the only piece of equipment that the California legislature has by law demanded be present on ambulances.[2]

Training in Emergency Care Needed

However, by far the greatest concern of physicians expert in emergency medical care is lack of emergency medical training for ambulance personnel. These physicians favor a state licensing program for drivers and attendants on all ambulances responding to emergencies. They also favored retaining the emergency vehicle status of ambulances with red light and siren. Of physicians who are acquainted with California's ambulance regulations, more were dissatisfied than satisfied with them, primarily because training requirements are considered inadequate.

Among the most popular recommendations were:

1. Rural ambulance services must receive state subsidy,
2. Emergency medical communication systems must be improved throughout the state,
3. All medical transportation should be regulated, including wheelchair cars, non-emergency transfers and air ambulance services, and
4. A statewide program to coordinate, organize, and subsidize all emergency medical transportation and emergency hospital services.

Eighty commercial air ambulance services were identified. The commercial companies maintain 161 fixed-wing aircraft and 41 helicopters. A large majority of the aircraft, in addition to serv-

ing as air ambulances, are used in other work. In 1968, a total of 1,432 patients were transported, of whom only 236 were emergencies carried by helicopter. Fifty percent of them were carried by three operators. About one in every 1,500 emergency ambulance trips was by helicopter in 1968. Most aircraft carry one patient and variable first aid equipment. There are no regulations covering the ambulance aspects of air service.

Ambulance ordinances or contracts were identified and collected for 19 or one-third of California's counties and 23, or six percent, of its 404 cities. Nineteen of the cities and 12 of the counties through either ordinances or contracts required both a driver and an attendant on each emergency ambulance. Two counties and seven cities required that both driver and attendant have a current advanced Red Cross First-Aid Certificate. Most cities and counties with regulations delegated responsibility for enforcement to their health or police agency.

Ambulance Collisions

Although the number of traffic accidents in general has increased considerably since 1963, the number of ambulance accidents has not. There is, however, a significantly higher proportion of injury-producing collisions between ambulances and other vehicles at intersections than between other vehicles. During the first nine months of 1969, 84 ambulance accidents were reported, 56 of which involved injuries and fatalities. Four persons were killed and 116 injured in these accidents. Eighteen of the injured were patients in ambulances. About the same number of accidents occurred going to as leaving the scene of an emergency. Red light and siren were in operation in over half of all of accidents. In 27 percent of the accidents the ambulance driver received a citation. In 66 percent of the accidents involving another vehicle the other driver was cited, most often for failure to yield to an emergency vehicle. During the nine-month study period ambulance accidents occurred most often on Friday between 3 p.m. and 6 p.m.

All of the area commanders for the California Highway Patrol (CHP) responded to a questionnaire about ambulance services for traffic accident victims. The CHP investigates all traffic accidents involving death or injury on freeways and roadways in unincorporated areas of California, and it places calls for almost 11,000 ambulance services annually. The CHP is responsible for regulation of ambulance services. It reported reasonable satisfaction with services in most locations throughout the state; however, there were serious problems in some areas because ambulance services were too distant. In about ten percent of the CHP areas some improper practices in extricating accident victims from wrecked vehicles were noted. The CHP also noted that traffic accident victims infrequently receive first-aid care before they or the ambulance arrive.

Ambulance operators and their employees expressed considerable concern about legal liability or suits involving patient care. Since this fear was reported to have an inhibiting effect on providing first aid services, an investigation of appellate court records was made to determine what facts were available. It was determined that the risk of legal action because of negligence taken against ambulance personnel, lay persons or even professional persons providing first aid or emergency care was remarkably low. As far as could be determined, traffic accidents, delays in reaching or delivering patients to the hospital, and patients slipping from cots or gurneys cover most of the reasons for suits brought against ambulance personnel. No suits concerned emergency medical care as such.

Judging from other surveys, California is remarkably different from other states in both its pattern of ownership of ambulance services and in their utilization. There are also pronounced differences within California between metropolitan and rural areas, particularly with respect to ownership of ambulance services, their availability, their personnel, extent of financial problems, communications, and response time.

A number of recommendations were made to assist the State and its local jurisdictions to correct those deficiencies in ambulance services where they were not in compliance with Federal Highway Safety Standards for Emergency Medical Care. The most important concerned making available throughout the state adequate emergency medical training for ambulance personnel and adequate first-aid training for every high school student. Also important was assigning legal responsibility to all local jurisdictions to provide ambulance services in compliance with standards of availability and quality of

service to be set by the State. Some form of financial assistance to ambulance operators also seemed urgent – particularly when increased training of personnel and availability of service are expected.

One of the most neglected aspects of ambulance service is communications. There is almost across-the-board lack of realization about the lifesaving potential and the opportunities for a more economic use of emergency services offered by modern communications. Each county should have such a system geared to its needs but also coordinated by a statewide network to deal with emergencies crossing county lines or covering several counties.

Emergency Call Listing Needed

Practically no help or information is given to the public about calling an ambulance in an emergency. Very few telephone directories provide an ambulance number among the front page emergency numbers. There is no single number designated or in use for the public to report an emergency, and a coin is usually needed for pay phones. Calls for ambulances may be relayed through several operators and agencies, thus increasing chances of error in the message. This survey documents the almost routine use of "Code 3" by ambulances to the scene (red light, siren, speed above limits, taking right of way) without knowing whether the situation warrants it. A good communications system with a trained dispatcher could, in some situations, obtain and forward information to the ambulance driver which could reduce unnecessary "Code 3" trips to the emergency.

Ambulance accidents could be reduced by requiring that ambulances either obey traffic signals at all intersections or be provided with equipment to change intersection traffic signals in their favor.

Most of the recommendations were directed toward bringing ambulance services into the medical care field. The delivery of medical care has been designated as the nation's most urgent health problem. Ambulance operations have been one of the most neglected segments of medical care services. There have been advances in emergency medical care which can be brought to the ill and injured to save their lives. If immediate care and medical transportation services are to include these advances they must be brought into the paramedical field. Ambulances can no longer be considered as merely transportation, but must take their rightful place as an essential component of the emergency medical care system.

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CAR CRASHES FROM CAROTID KINKING CAUSED BY CRANING

Five of my patients had car wrecks when they turned their head while driving. In each I subsequently demonstrated a kinked internal carotid artery. One of the patients has had two wrecks. Another three patients with kinks bowed their head in church and had hemiparesis. On an arteriogram, with the head in an extended position the artery was open; with the head in a flexed position with the needle still in place, the vessel almost kinked off flow.

I nearly had a disaster once in testing one of the car wreck patients. He was sitting across from my desk and I said, "Hold your head down." He did—and fell over onto the floor. Now I ask any patient with transient symptoms to hold his head in extended, flexed, and rotated positions for 30 to 45 seconds to see whether I can reproduce symptoms suggesting some sort of angulation that might be causing reduced flow. Then to try to prove it with arteriograms, I have to get the head in that same position.

—E. STANLEY CRAWFORD, M.D., Houston

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